TRENDS IN HIP FRACTURE HOSPITALIZATIONS AND ASSOCIATED HEALTH OUTCOMES IN ALBERTA, 1994-1997

Technical Report

By

Colleen J. Maxwell, PhD

Hude Quan, MD, PhD

David B. Hogan, MD

Jenny X. Zhang, MPA, MEc

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For more information contact:

David Johnson, Coordinator
Alberta Centre for Health Services Utilization Research
22nd Floor, Telus Plaza North Tower
10025 Jasper Avenue NW
Edmonton, AB T5J 2N3
Ph: 780-415-0219
Fax: 780-422-2880
Email: david.johnson@gov.ab.ca

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OBJECTIVE

The primary aim of this report was to explore whether the receipt of home care services shortly following acute care discharge is associated with improved health outcomes including mortality and re-hospitalization among hip fracture patients in Alberta during 1994-1997. As part of this investigation, we also examined descriptive information regarding recent trends in hip fracture hospitalization rates and explored the associations between patients' demographic, health and service use characteristics and subsequent outcomes.

The specific objectives of the present study were:

1. Compare trends in the age - and sex-specific hospitalization rates for hip fracture and seasonal distribution of hip fracture hospitalizations in Alberta during 1994-1997.

2. Provide descriptive data on the demographic and health (comorbid conditions, in-hospital and 1-year mortality) and health service use (length of hospital stay, receipt of home care services and re-hospitalization following discharge) characteristics of patients admitted to acute-care hospitals for hip fractures in Alberta during 1994-1997.

3. To examine the relative importance of various demographic and health characteristics as risk factors for the health (in-hospital and 1-year mortality) and service use outcomes (length of index hospitalization, home care service use, re-hospitalization at 1-year) among Alberta hip fracture patients during this time period.

INTRODUCTION

Hip fractures represent a leading cause of hospitalization among seniors and are of particular importance for elderly women. Hospital admission rates for hip fractures increase exponentially with increasing age among women and men, although the incidence of hip fracture in elderly women is approximately twice that reported in elderly men.[1-10] The current and projected health and socioeconomic implications of hip fractures among older persons in North America are substantial. Recent estimates indicate that approximately $2.4 billion is spent annually on the medical treatment of fall-related injuries among Canadians.[11] Almost $1 billion of this amount is associated with the treatment of fall injuries in older persons with the majority (40-50%) of these injury-related hospitalizations being attributable to hip fractures.[2,11,12] In the United States, over 300,000 hip fractures occur annually in individuals older than 65 years (approximately 90% of all hip fractures).[13] According to recent US estimates,[14] osteoporotic hip fractures among older adults account for $8.7 billion per year in direct costs for medical care. Including direct as well as informal care costs (e.g., provided by family and friends), the incremental costs of caring for an older, community-based hip fracture patient during the first year following injury ranges from $16,300 to $18,700 US.[15] Concern about the future health care burden of hip fractures among Canadian seniors has been highlighted by recent projections which suggest an exponential rise in the rate of hip fractures over the next 40 years, with total numbers projected to increase from 23,375 in 1993/94 to 88,124 by 2,041.[1]

In addition to direct health care costs, hip fractures are associated with both significant morbidity and mortality.[7,10,16,17] The highest risk of mortality after hip fractures occurs in the first 4 to 6 months, with the most vulnerable patients being those of advanced age and with multiple comorbid conditions and functional impairments.[1,16,18,19] Estimates of mortality rates at 1 year following fracture range from 14 to 24 percent.[20-25] Many studies further indicate that men have a significantly higher death rate after a hip fracture than women.[1,3-5,8,10,22,23,26-28]

The adverse consequences of hip fractures on older patients' short and long-term functional abilities[16,19,29,30] and quality of life[31] are also significant. Many patients require extended rehabilitation following the injury. According to a recent review, one year after hip fracture, 40% of patients remain unable to walk without assistance and 60% experience difficulty in performing at least one essential activity of daily living.[19] The significant decline in functional ability among older adults following the occurrence of a hip

fracture has been observed for both basic and instrumental activities of daily living (e.g., meal preparation, shopping etc.).[30] This resulting loss of independence also significantly increases the older hip fracture patient's risk of admission to a continuing care facility. Studies indicate that approximately 20-30% of patients, primarily women, enter a long term or continuing care facility shortly (6-12 months) following the occurrence of a hip fracture.[19,32-34] There is also some data to suggest that living in an institution is associated with an increased risk of hip fracture in older people.[35] However, the specific factors attributed to an increased risk of hip fracture in the elderly were not identified in the study.

Although data are lacking, it has been suggested that the type of post-acute setting (e.g., home care, rehabilitation hospital, nursing home) may determine the magnitude of functional recovery observed among hip fracture patients in the first 6-12 months after hospital discharge.[36-37] In recent years, there has been a dramatic shift in the care of older persons from the institutional to the community-based setting. A study of hip fractures in Ontario showed that for patients who were discharged home, the proportion receiving home care services doubled between 1981 and 1992.[3] There is some evidence indicating that the adverse health and functional outcomes associated with hip fractures may be reduced by early planned rehabilitation involving a multidisciplinary team coupled with careful follow-up by continuing care services.[34,37-39] It is anticipated that the recent reallocation of health care resources to community care in Alberta may result in improved access to, and quality of care, for hip fracture patients following their acute-care hospitalization. Additional community support may reduce the risk of re-hospitalization, institutionalization and death among this high-risk senior population.

METHODS

Data for these analyses were obtained from administrative databases maintained by Alberta Health and Wellness for the fiscal years 1994/95, 1995/96 and 1996/97. The three databases examined included the Alberta Health Care Insurance Plan (AHCIP) Registry, the CIHI Hospital Inpatient database and the Home Care Information System (HCIS). The fiscal year is defined as the period extending from April 1 of the identified year to March 31 of the following year. The study interval was limited to the years 1994-1997 due to limitations of data availability beyond 1997 for home care service use at the time the data linkage was conducted.

Study Population

Alberta Population

For each study year, the number of Albertans aged < 65 years, 65-74 years, 75-84 years, and 85 years and older at mid-year was estimated by calculating the mean number of people in each age-group in the Alberta Health Care Insurance Plan (AHCIP) Registry on March 31 of the previous and present year.

Hip Fracture Patients

For each fiscal year within this three-year period, all separations from acute care hospitals in Alberta for residents who were in the Alberta Health CIHI Hospital Separation Inpatient database[a] were examined. Hip fracture patients included in this study were defined based on the following three criteria:

- Resident of Alberta at time of admission - defined as a person with a valid Regional Health Authority allocation as assigned at date of admission. Persons with unknown addresses and those who migrated out of province within one year after discharge were excluded.
- Discharge diagnosis - defined as the most relevant or any secondary diagnosis with ICD-9-CM (*International Classification of Disease, 9th revision*) categories 820.0-820.9 (which include transcervical fractures, pertrochanteric fractures and fractures of an unspecified part of the neck of the femur).
- Inpatient surgical procedure codes – defined as having any of the following ICD-9-CM procedure codes listed among the 10 procedure codes available, 79.05, 79.15, 79.25, 79.35, 79.75, 79.85, 78.55, 81.51, 81.52 and 81.53.

All hip fracture hospitalizations, as defined above, were examined. Patients were allocated to age/sex subgroups according to their demographic data collected at the time of admission. For patients identified as having multiple hip fracture related hospitalizations during the study interval only the first admission (based on date of admission) was included in the present analyses. Of the total number of patients meeting the above criteria (n=5,656), 5,352 hip fracture cases were successfully linked with the Alberta Health Care Insurance Plan (AHCIP) registry and included in the analyses.

[a] From CIHI Hospital Inpatient database. A hospital separation is a hospital stay with a defined admission and discharge (separation) date. All hospitalizations that require the overnight use of an inpatient hospital bed are recorded as a separation. Transfers and readmissions are usually captured as new separations.

Measures

Demographic and Health Characteristics

In addition to patients' demographic characteristics (age, sex, health region of residence), information on the length of stay of the index hospitalization and the presence of selected comorbid conditions was collected from the Alberta Health hospital separation database. Length of in-patient acute care stay in days was categorized to provide short, intermediate and long stay groups representing approximately 20, 60, and 20 percent of the sample, respectively. The health conditions examined and included as covariates in the present analyses were based on the Charlson comorbidity index.[40] The presence of each diagnostic category (excluding liver disease and HIV/AIDS) was defined as any mention of the category among the 16 diagnostic ICD-9-CM codes available for each index hospitalization using Deyo's ICD-9-CM algorithms.[41] These health conditions were examined as indicators of the overall health status of hip fracture patients and were adjusted for in our analyses to control for case-mix.

Discharge Setting

The setting to which patients were transferred to at the time of discharge from the index hospitalization was determined from two variables available in the CIHI Hospital Inpatient database: 1) a function code based on purpose of the transfer (e.g., acute care, rehabilitation); and 2) a site code based on type of institution (e.g., nursing home, home care, lodge). Data from these two variables were combined to form a categorical variable for discharge location defined as:

- Community - includes private dwelling, private dwelling with home care, senior citizens lodge;
- Long-term care - includes nursing home, auxiliary hospital, sub-acute care beds in long-term care;
- Acute care;
- Rehabilitation;
- Other - includes same day surgery, emergency department, psychiatric facilities, unclassified/unknown health institutions.

Health Service Use

Home Care Use

Data on the receipt of home care services (including date of service) within 90 days of discharge from the index hospitalization were obtained via

linkage with the Home Care Information System (HCIS).[b] The receipt of home care services during this time interval was coded as a binary variable (yes/no) when examined as a covariate for the other health outcomes (e.g., 1-year mortality from date of discharge and re-hospitalization, see below). However, for the examination of patient characteristics associated with home care use, this variable was coded according to the date of service use (time-to-use) within the 90-day period following discharge.

Re-Hospitalization

To examine morbidity-related consequences following hospitalization for a hip fracture, an outcome variable reflecting whether the patient was re-hospitalized within 1-year following discharge from the index hospitalization was also calculated. This outcome variable was based on data from the hospital separation database and was coded as time-to-re-hospitalization. In order to exclude re-hospitalizations that represented transfers between acute care hospitals, all multiple hospital admissions during the study interval separated by ≤ 1day were excluded from this outcome variable.

Accurate provincial information on admission to a continuing care facility during our study interval was not available. Thus, we were not able to examine the risk of institutionalization associated with patients' health and service use characteristics.

Mortality Outcomes

Three outcome measures for mortality were examined including:

- in-hospital deaths (based on data from the hospital separation database, coded as a binary variable);
- 1-year mortality from date of index admission (based on data from the hospital separation and the AHCIP registry databases[c], coded as a time-to-death variable);
- 1-year mortality from date of index discharge (based on data from the AHCIP registry database, coded as a time-to-death variable).

[b] Home care services are services provided to clients at their residence (including nursing homes, group homes, and resident lodges) by professional and support staff. Self-managed home care services, where clients are provided funds to seek their own care providers, are also included.

[c] The AHCIP registry database includes a death indicator field (yes/no) provided by vital statistics, date of death was determined from the date of financial deregistration.

Analysis

For each fiscal year and for all three years combined the age- and sex-specific hospitalization rates for hip fractures were calculated. To explore potential seasonal patterns in the distribution of hip fracture hospitalizations, each fiscal year was categorized as follows:

1. Spring: # hip fracture hospitalizations in the last week of February, plus the total number in March and April, plus those occurring in the first three weeks of May.
2. Summer: # hip fracture hospitalizations in the last week of May, plus the total number in June and July, plus those occurring in the first three weeks of August.
3. Fall: # hip fracture hospitalizations in the last week of August, plus the total number in September and October, plus those occurring in the first three weeks of November.
4. Winter: # hip fracture hospitalizations in the last week of November, plus the total number in December and January, plus those occurring in the first three weeks of February.

Bivariate associations between the selected demographic and health characteristics and the outcome variables were examined using cross-tabulations and chi-square tests of significance for categorical variables and t-tests for continuous variables.

Multivariate logistic regression was used to examine the independent effects and relative importance of patients' demographic and health characteristics to the risk of in-hospital mortality. For the remaining outcome variables with information on the time to event following the index hospitalization (e.g., time to death from admission and discharge, time to re-hospitalization, time to receipt of home care services), multivariate Cox proportional hazards regression models were used to examine the independent effects and relative importance of patients' demographic, health and health service use characteristics to the outcomes of interest. Multiple linear regression analysis was employed to investigate the statistical significance of time trends in the age- and sex-specific hip fracture hospitalization rates and to examine patients' characteristics associated with the length of stay for the index hospitalization.

In the above multivariate analyses, the following variables were included as covariates: age, sex, fiscal year, length of stay of index hospitalization, presence of select comorbid conditions, discharge location and, where relevant, receipt of home care within 90 days of discharge. These analyses

were repeated including health region of residence (Calgary, Capital and all other regions) as an independent variable. With the exception of the model predicting length of stay during the index hospitalization, the health region variable was not retained in the final models because it was not found to be an important predictor of the main outcomes. Also, the inclusion of health region in the various models did not alter any of the risk estimates obtained for the other factors examined. For select outcomes, subjects not at risk of experiencing the event of interest were excluded from the models. Specifically, patients who died during the index hospitalization were excluded from the models for risk of 1-year mortality from discharge, re-hospitalization and receipt of home care. Also, patients discharged directly to a nursing home were excluded from the model examining factors associated with the receipt of home care within 90 days of discharge.

RESULTS

Trends in Hospitalization Rates for Hip Fractures:

For the following results, the corresponding data for each of the figures are presented in Appendix A (Tables A1-A12).

As shown in Figure 1, hip fracture hospitalization rates were higher among persons aged 65+ years as compared with all ages and among women compared with men. For women aged 65+ years, the rates increased between 1994/95 and 1995/96 and then decreased slightly during the subsequent year. The rates for men aged 65+ years increased slightly across all three years of the study.

For all three years examined, the data showed an exponential increase in hip fracture hospitalization rates with increasing age (Figure 2). This increase was most pronounced among women aged 75 years and older (Figures 3, 4). Among women and men aged < 65 years, the hospitalization rates for hip fractures remained relatively stable across the three years. The rates among women aged 65-74 and 75-84 increased during 1994/95 – 1995/96 and then decreased slightly during the 1995/96-1996/97 interval. However, there was a consistent and statistically significant increase in hip fracture hospitalization rates across the three years among women aged 85+ years ($p=.016$). The age-specific rates among older men increased during each of the three years examined although this trend was not statistically significant. Figures 5a and 5b illustrate the number of hip fracture hospitalizations among women and men of select age groups observed during the study interval. These data reflect the trends in age- and sex-specific rates discussed above.

The distribution of hip fracture hospitalizations among all patients (Figure 6) and those 65+ years (Figure 8) according to season illustrated a relatively higher percentage of hip fracture hospitalizations occurring during the winter months. The one exception to this seasonal pattern was the 1994/95 fiscal year where the percentage peaked during the fall season. Both sexes exhibited relatively higher percentages of hip fracture hospitalizations during the winter, although there was greater variability in seasonal patterns across years for males of all ages (Figures 7a, 7b). No age/sex subgroup showed a statistically significant trend by season.

Demographic, Health & Health Service Use Characteristics:

Table 1 presents the demographic, health and service use characteristics observed among the sample of 5,352 patients hospitalized for a hip fracture in Alberta during the three study years. Approximately 70% of the patients were women and most patients (65-70%) were aged 75 years or older (see also Figures 5a, 5b). The sex distribution remained consistent across the three years although there was a nonsignificant increase in the average age of the patient sample from 75.9 years in 1994/95 to 77.1 years in 1996/97. The proportion of patients aged 65 years and older increased significantly across the three years (83.1% to 86.6%, p=.016). The average length of stay for the index hospitalization decreased over the three years from 16.7 (sd 30.2) days to 13.6 (sd 14.4) days although this trend was not statistically significant.

The most common comorbid conditions observed among the total sample of hip fracture patients were chronic obstructive pulmonary disease (COPD-19.3%), dementia (17.3%), congestive heart failure (13.4%), diabetes & associated complications (10.6%), cerebrovascular disease & hemiplegia (9.8%) and myocardial infarction (8.2%). A similar pattern in the distribution of these conditions was observed across the three years. However, there was a statistically significant increase in the proportion of patients with diabetes & associated complications during this time interval (8.9% to 11.9%).

During the three-year study period, 276 patients (5.2%) died while in hospital. The percentage of hip fracture patients who died during their index hospitalization increased significantly from 4.7% in 1994/95 to 6.3% in 1996/97. Including these in-hospital deaths, a total of 1,154 patients (21.6%) died within one year of hospital admission for hip fracture. The 1-year mortality rate from admission showed a statistically significant increase across the three years (19.5% to 23.1%) primarily reflecting the significant increase observed for in-hospital mortality. Mortality during the year after

discharge increased (nonsignificantly) between 1994/95 and 1995/96 (16.3% to 18.5%), but remained stable between 1995/96 and 1996/97.

Data regarding the discharge location for hip fracture patients examined during the study interval are presented for the total sample in Figure 10 and according to health region in Figure 11. As shown in Figure 10, most patients were discharged to a community setting (38%) or to long-term care (34%). Approximately 23% were directly transferred to acute care and 4% to rehabilitation. A very small proportion (1%) was discharged to 'other' settings, including psychiatric facilities and unclassified or unknown health institutions. Hip fracture patients from the Calgary health region were more likely than those from the Capital or other health regions to be discharged directly to the community (61% compared with 22% for the Capital and 32% for other regions). Conversely, patients from the Capital region were more likely to be discharged to long-term care (62%) or to rehabilitation (12%). This latter finding is expected given the availability of sub-acute beds and rehabilitation (at the Glenrose Hospital) in the Capital region during this time interval. Patients residing in the less populated, predominantly rural health regions were significantly more likely than those from the Calgary or Capital regions to be discharged to acute care (49%) following their index hospitalization.

Approximately two thirds of hip fracture patients received home care services within 90 days of discharge from the index hospitalization and there was a statistically significant increase in the proportion of patients receiving such services over the three study years (61.7% to 70.0%). The proportion of hip fracture patients receiving home care within 90 days of discharge did not vary significantly across the two major urban health regions (Calgary 67.5% and Capital 70.1%) but was significantly lower among those from the other regions (62.2%). See Table A13 in the appendix for additional data regarding health care characteristics of patients residing within each regional health authority.

The percentage of hip fracture patients who were re-hospitalized within one year of discharge remained relatively consistent (at 33%) across the three study years (see also Figure 13).

Predictors of Health & Health Service Use Outcomes:

Table 2 presents the results from the multivariate logistic regression analysis of patients' characteristics associated with mortality during the index hospitalization (for hip fracture). During the hospital stay, a significantly higher risk of death was observed for males and for those aged 75 years or older. Male hip fracture patients were twice as likely to die during

hospitalization compared with female patients after adjusting for age and the presence of various comorbid conditions. Patients aged 85+ years exhibited the highest risk for in-hospital mortality (adj. OR=6.20, 95% CI 2.93-13.12). A relatively short (1-5 days) or long (16+ days) length of in-patient stay was associated with a significantly higher risk of death during hospitalization. A significantly higher risk for in-hospital mortality was also observed among patients with the following comorbid conditions: congestive heart failure, cancer, cerebrovascular disease / hemiplegia, chronic renal disease, dementia and chronic obstructive pulmonary disease. Year of admission was not significantly associated with in-hospital mortality.

The findings regarding patients' characteristics associated with mortality during the year following hospital discharge (i.e., excluding in-hospital deaths) are presented in Table 3. As shown for in-hospital mortality, older (65+ years) and male hip fracture patients were significantly more likely to die during the year after hospital discharge. Patients with a longer length of stay during the index hospitalization were also at significantly higher risk for mortality during the year after discharge. Relative to the 1994/95 period, patients admitted to hospital for hip fractures in 1995/96 showed a significantly higher risk for mortality during the year following discharge. A significantly higher risk of death during the year following discharge was evident for patients with the following comorbid conditions: cancer, dementia, chronic obstructive pulmonary disease, congestive heart failure, cerebrovascular disease & hemiplegia and chronic renal disease. Relative to patients discharged to the community, those transferred directly to acute care, long-term care or other settings were significantly more likely to die during the year following discharge. After adjusting for the above covariates, hip fracture patients receiving home care services within 90 days from hospital discharge were significantly less likely to die during the year following discharge compared with patients not receiving such services (adj. HR=0.55, 95% CI 0.48-0.64).

The various patient characteristics associated with risk of re-hospitalization during the year following the index hospitalization are presented in Table 4. Sex was not significantly associated with risk of re-hospitalization. Patients aged 85+ years were significantly less likely to be re-hospitalized in the year after discharge. However, patients with a longer length of stay during the index hospitalization and those with certain comorbid conditions (myocardial infarction, congestive heart failure, chronic obstructive pulmonary disease, cancer and diabetes or associated complications) were significantly more likely to be re-hospitalized during the year following fracture. Hip fracture patients with dementia exhibited a significantly lower risk for re-hospitalization during the year following hospital discharge. Compared with

patients discharged to the community, only those transferred to acute care at discharge were significantly more likely to be re-hospitalized in the following year. Hip fracture patients receiving home care services within 90 days from hospital discharge were significantly more likely to be re-hospitalized during the year following discharge compared with patients not receiving such services (adj. HR=1.62, 95% CI 1.44 -1.82).

Table 5 presents the findings regarding patients' characteristics associated with the receipt of home care services within 90 days following discharge from the index hospitalization. Older (65+ years) and female patients were significantly more likely to receive home care services within 90 days of discharge. Hip fracture patients with a longer length of stay during the index hospitalization and with rheumatologic or peptic ulcer disease were also significantly more likely to receive home care services during the 90 days after discharge. However, patients with dementia and those with a relatively shorter length of in-patient stay, were significantly less likely to receive home care during the 90 days following discharge. Direct transfers from hospital to nursing home were excluded from this analysis. Patients hospitalized for hip fractures in 1996/97 and to a lesser extent, in 1995/96, were significantly more likely than those hospitalized during 1994/95 to receive home care services within 90 days following discharge. Relative to patients discharged to the community, those transferred to all other settings (long-term care, acute care, rehabilitation and other) were significantly less likely to receive home care within 90 days following discharge.

The results of the regression analysis examining the demographic and health characteristics associated with length of stay during the index hospitalization are presented in Table 6. The direction and magnitude of the association is reflected by the beta estimate. A significantly longer length of hospital stay following hip fracture was found for older age patients (especially 75+ years) and for those with various comorbid conditions (cerebrovascular disease & hemiplegia, congestive heart failure, chronic renal disease, peripheral vascular disease, and cancer). Length of hospital stay was significantly lower among hip fracture patients admitted to hospital in 1995/96 and 1996/97 compared with 1994/95. Compared with hip fracture patients from the Calgary region, patients from the Capital or other regions also had a significantly shorter length of stay during the index hospitalization. For all three years combined, the mean (sd) length of stay for patients from the Calgary region was 17.5 (16.5) days compared with 13.7 (16.9) days for patients from the Capital region and 13.4 (25.0) days for patients from all other regions. Across the three years examined, the

reduction in mean length of stay for the index hospitalization was most evident for patients from the Capital region, particularly during the 1995/96 fiscal year. The changes in mean length of stay across the three years for the different health regions were as follows:

	1994/95	1995/96	1996/97
Calgary Region	18.7 (17.7)	16.8 (15.6)	17.2 (16.3)
Capital Region	17.2 (22.6)	12.9 (16.1)	11.6 (11.0)
Other Regions	15.2 (39.1)	12.8 (16.3)	12.5 (14.5)

DISCUSSION

Consistent with previous reports,[1-10] hospitalization rates for hip fractures in Alberta during 1994-1997 were found to increase exponentially with increasing age among men and women and were significantly higher among women than men across all age groups. The age and sex differences in the rates and absolute numbers of hip fractures observed during the study period clearly illustrate the public health importance of hip fractures among older women. In a recent review of injury-related hospitalizations among older Canadians, Raina et al.[2] reported that relative to other provinces, Alberta had the highest rate of hospitalization due to fractures of the lower limb among females (1,291 per 100,000). At present, it remains unclear whether, and to what extent, hip fracture hospitalization rates are increasing among the older population. According to earlier Canadian investigations, the age-standardized rates for hip fracture hospitalizations remained fairly stable during the 1980s and early 1990s.[2,3,7,12] Women aged 85 years and older in our study represented the only age/sex subgroup to demonstrate a significant increase in hip fracture hospitalization rates during 1994-1997. Recent US figures for the period 1988-96 showed that hip fracture hospitalization rates remained stable for men but increased significantly among women from 972 to 1,356 per 100,000.[5] As stated in this US report, the overall increase in hip fracture hospitalization rates among women may be explained, in part, by the increasing population of very old adults (i.e., aged 85+ years). In addition to the aging population, other relevant considerations for further research will be to examine data regarding current and projected trends in the incidence of osteoporosis and falls among older women.

As expected, the distribution of hip fracture hospitalizations in Alberta during the study period provided some support for a seasonal pattern, with a higher proportion of fractures occurring in the winter as compared with the summer

months. However, no age/sex subgroup showed a statistically significant trend by season. Other investigations have also reported a seasonal pattern in hip fracture hospitalizations,[1,42,43] However, this trend has not consistently been found to be statistically significant.[1] In addition to inclement weather conditions (e.g., snow, ice and freezing rain), winter months may predispose to a higher hip fracture risk among older persons because of slower reaction times and winter bone loss from Vitamin D deficiency.[43,44] Further research on the relative contributions of such factors to the occurrence of hip fractures among younger and older populations are necessary given the potential implications for targeting specific interventions across certain regions.

During the study period, there was a significant increase in the proportion of hip fracture patients who were aged 65 years and older. There was also a modest increase in the average age of this patient population from 75.9 to 77.1 years. This relative aging of the hip fracture population likely accounts for the increase in the in-hospital and 1-year crude mortality rates observed across the three years. Several studies have reported that hip fracture associated mortality rates have remained stable, or declined slightly, over the last few decades.[2,3,7] Alberta patients hospitalized for hip fractures during 1994-1997 also tended to present with a number of comorbid conditions, the most common being chronic respiratory and cardiovascular diseases, dementia and diabetes or associated complications. With the exception of diabetes, which showed a significant increase in prevalence across the three years (8.9 – 11.9%), there was little change in the relative prevalence of these comorbid conditions among hip fracture patients from 1994 to 1997.

The average length of stay during the index hospitalization decreased from 16.7 to 13.6 days during 1994 – 1997. After adjusting for patients' age, sex and select comorbid conditions, year of admission was found to have a significant inverse association with length of in-patient stay. When examined by health region, the decline in length of stay for the index hospitalization during the study period was most evident for patients from the Capital health region. For the total sample examined across the three years, patients from the Capital or from other regions exhibited a significantly shorter length of index stay compared with patients from the Calgary region. This trend of declining length of acute-care stay among hip fracture patients is consistent with previous Canadian[1-3,7] and US reports.[24] Although recent US data suggests that the reduced length of stay has had no significant impact on outcomes such as mortality and institutionalization,[24] further research on the effects of shorter hospital stays on these and other functional and quality of life outcomes among older Canadian patients appears warranted. Our analyses indicate that this period of decline in length of acute-care stay was

also associated with a significant increase in the proportion of patient receiving home care services shortly following discharge (i.e., within 90 days). Unfortunately, the lack of a comprehensive and accurate database for continuing care (nursing home) services in Alberta limited our ability to examine the consequences of these trends among hip fracture patients. Consistent with previous reports,[1-3] length of stay following hospitalization for hip fracture in Alberta increased significantly with increasing patient age and was considerably longer among patients in relatively poorer health (e.g., older persons with diagnoses of stroke, heart failure, renal or peripheral vascular disease).

The relative differences across health regions with regard to the reduction in length of stay for the index hospitalization across the study period is likely a reflection of differences in the primary discharge location for patients from these three regions. As illustrated in Figure 11, the primary type of discharge setting was found to vary considerably for patients from the different health regions. In particular, hip fracture patients from the Calgary region were significantly more likely to be discharged directly to a community setting (e.g., private dwelling with or without home care, senior citizens lodge) whereas patients from the Capital region were significantly more likely to be discharged to a long-term care setting (e.g., nursing home, auxiliary hospital, sub-acute beds in long-term care). Interestingly, hip fracture patients residing in the less populated, rural health regions were significantly more likely to be discharged to local community acute care hospitals following treatment for their hip fracture. Unfortunately, the data available for the present analyses do not allow us to make any clear statements regarding which of these various settings of care are more effective and/or cost-effective for the ongoing treatment and management of hip fracture patients.

The overall in-hospital mortality rate during the study interval was 5.2%. Including these in-hospital deaths, a total of 1,154 hip fracture patients (21.6%) in Alberta died within one year of hospital admission. This 1-year mortality rate is consistent with that observed in previous research.[20-25] Comparable with other reports,[1,3-5,8,10,22,23,26-28] male hip fracture patients were approximately twice as likely to die during hospitalization compared with female patients. This increased mortality risk observed for male patients declined slightly but remained statistically significant during the year following discharge. Males may be a greater risk for death following fracture for a number of reasons, including an increased likelihood for presenting with more severe or complex comorbid conditions or for experiencing more traumatic falls and injuries. As also illustrated by others,[1,16,18,19,21,25,34,45] Alberta patients of advanced age (especially those 85+ years) and in

relatively poor health (e.g., with heart failure, cancer, stroke, renal disease, dementia and chronic respiratory disease) were at significantly greater risk of dying during the hospital stay and in the year following discharge. Patients with relatively shorter (1-5 days) or longer (16+ days) acute-care stays following fracture were significantly more likely to have died during hospitalization. A longer length of in-patient stay was also associated with a significantly higher risk of mortality in the year following discharge after adjusting for relevant covariates. This increased risk among longer stay patients likely reflects the generally poorer health status and the severity or complexity of the comorbid conditions among this patient sub-group. Interestingly, after adjusting for other covariates, hip fracture patients receiving home care services shortly following acute-care discharge were significantly less likely to die during the year after discharge.

During the study interval, approximately two thirds of hip fracture patients (n=2,965) received home care services within 90 days of discharge. As noted above, this proportion increased significantly across the three years, even after adjustment for potential changes in patients' demographic and health characteristics. Older (65+ years) and female patients were significantly more likely to receive home care services shortly following discharge. With the exception of rheumatologic and peptic ulcer disease, few comorbid conditions exhibited a significant positive association with the receipt of home care services. However, patients with relatively longer acute-care stays (16+ days), likely reflecting a poorer health status and lack of informal care providers, were significantly more likely to receive home care following discharge. Conversely, patients with dementia were significantly less likely to receive such services during the 90 days following discharge. Such findings may reflect the increased risk for institutionalization and death among such patients shortly following discharge.[33,34] The significantly lower risk for receipt of home care services observed for patients with relatively short acute-care stays (1-5 days) is likely due to their removal from the cohort because of early death or transfer to other acute-care settings.

As noted above, hip fracture patients who received home care services shortly following hospital discharge were significantly less likely to die during the year after discharge. However, the receipt of such services was also associated with a significantly greater risk for re-hospitalization during this year, even after adjusting for patients' demographic and health characteristics. Compared with patients not receiving home care services within 90 days of discharge, those who received these services were 1.6 times more likely to re-enter the acute-care hospital in the subsequent year. This finding may be due to the fact that patients receiving home care

services were less likely to die or be institutionalized[46] during the subsequent year. Alternatively, it may be that home care providers are detecting health problems earlier among these patients resulting in appropriate and timely use of health care services. In this manner, home care providers may act as an advocate for these patients and provide on-going contact with, and access to, the health care system. There is supporting evidence from recent US research that the receipt of home health care shortly following acute-care discharge may significantly improve functional outcomes but also result in a significantly higher risk for re-hospitalization among hip fracture patients.[37] Other patient characteristics associated with an increased risk for re-hospitalization in the year following discharge included a longer length of stay during the index hospitalization and the presence of cardiovascular and chronic respiratory conditions, cancer and diabetes. The lower risk of re-hospitalization observed among hip fracture patients with dementia likely reflects their increased risk for institutionalization and death following fracture.[33,34]

Our findings should be interpreted with caution given the potential limitations associated with the administrative data examined. In general, previous efforts have provided some support for the validity of comparable methods for examining trends in hip fracture rates.[1] Although more recent research has raised some concern about the potential for missing a small proportion of hip fracture cases when using administrative databases.[47] Our analyses regarding the determinants and health consequences of the receipt of home care services in the post-acute period among hip fracture patients in Alberta are also limited by a number of factors. Most importantly, we were not able to examine changes in patients' risk for institutionalization following hip fracture due to a lack of a comprehensive and accurate continuing care database for Alberta residents. Thus, we were limited in our ability to answer a number of important questions, including whether the trend toward shorter length of acute-care stays has potentially increased patients' risk for institutionalization and what type of post-acute setting is associated with the best outcomes. The lack of detailed institutionalization data represents an important barrier to a comprehensive analysis of the potential cost-effectiveness of home care services for this patient population. Our multivariate analyses of the various health outcomes were also limited by a lack of data on patients' functional and quality of life measures and relevant sociocultural factors (e.g., marital status, availability of informal care, ethnic background) that may represent important predictors of subsequent outcomes, including mortality[23] and re-hospitalization. Others have also noted the importance of other factors not examined in the present analysis (e.g., a shorter time-to-surgery) for improving survival rates among hip fracture patients.[20,21]

CONCLUSIONS

The increase in the absolute number of hip fracture patients due to the aging population has significant implications for increased health care utilization and costs and for the health and well-being of seniors in Alberta. As demonstrated by our findings and those of previous research, hip fractures cause significant hospitalization, disability and loss of independence and excess death. In Alberta, hip fracture hospitalization rates increased significantly during 1994-1997 among the oldest-old subgroup of women (aged 85+ years). At present, it is unclear to what extent hip fracture rates may increase further as a result of changes in the incidence of major risk factors for falls and associated fractures and in particular, osteoporosis. It is possible that more effective forms of prevention and treatment will substantially reduce the burden association with osteoporosis. Conversely, the incidence of osteoporosis may increase in future cohorts of older women as a result of increasing smoking rates and decreasing physical activity levels currently evident among younger-age women. Recent Canadian estimates suggest that preventing falls among the elderly would result in over 7,500 fewer hospitalizations and over 1,800 fewer persons with serious disabilities over the age of 65. The net savings resulting from a 20% reduction in hospitalizations due to falls would be $138 million annually.[11]

Our findings indicate that hip fracture patients in Alberta are becoming older and may be presenting with more comorbid conditions but are remaining in the acute-care setting for shorter periods of time. Significantly more patients are receiving home care services shortly following discharge and the receipt of such services is associated with a positive effect in terms of improved survival. However, hip fracture patients receiving home care services following discharge are also more likely to be re-hospitalized in the subsequent year. Future efforts in this area will need to incorporate more comprehensive analyses of the utilization and costs-benefits of the various post-acute settings (including continuing care facilities) providing care to hip fracture patients in Alberta. It is important that these future efforts also include functional and quality of life outcomes relevant to older persons as well as mortality and health service use indicators.

Table 1: Characteristics Of Patients Admitted To Hospital For Hip Fractures In Alberta, 1994/95 – 1996/97

Characteristic	Total (n=5,352)		1994-95 (n=1,560)		1995-96 (n=1,878)		1996-97 (n=1,914)	
	%	#	%	#	%	#	%	#
Female	68.8	3,684	68.1	1,063	69.8	1,310	68.5	1,311
Male	31.2	1,668	31.9	497	30.2	568	31.5	603
<65 years *	15.0	803	16.9	264	15.0	282	13.4	257
65+ years	85.0	4,549	83.1	1,296	85.0	1,596	86.6	1,657
65-74	17.3	923	16.6	259	18.1	340	16.9	324
75-84	35.7	1,908	35.0	546	36.6	688	35.2	674
85+	32.1	1,718	31.5	491	30.2	568)	34.4	659
Mean age (sd)	76.4	(15.1)	75.9	(15.7)	76.2	(14.6)	77.1	(15.1)
Mean length of stay (sd)	14.7	(20.8)	16.7	(30.2)	14.1	(16.1)	13.6	(14.4)
(range)	(1-636)		(1-636)		(1-167)		(1-161)	
Health Region (residence)								
Calgary	29.5	1,576	28.1	439	30.5	573	29.5	564
Capital	26.6	1,426	27.0	421	24.4	459	28.5	546
All Others	43.9	2,350	44.9	700	45.1	846	42.0	804
Comorbid Conditions								
COPD [a]	19.3	1,032	18.6	290	18.7	352	20.4	390
Dementia	17.3	927	18.3	285	16.2	305	17.6	337
Congestive heart failure	13.4	719	12.7	198	12.6	237	14.8	284
Diabetes & complications*	10.6	566	8.9	138	10.7	201	11.9	227
Cerebrovascular disease /Hemiplegia	9.8	526	8.8	137	9.6	181	10.9	208
Myocardial infarction	8.2	439	7.8	121	7.9	149	8.8	169
Peripheral vascular disease	4.1	217	3.9	61	4.0	75	4.2	81
Cancer	3.6	194	3.0	47	4.0	75	3.8	72
Rheumatologic disease	3.1	166	3.2	50	3.0	57	3.1	59
Peptic ulcer disease	2.4	128	2.4	38	2.1	45	2.1	45
Chronic renal disease	1.4	77	1.2	18	1.2	23	1.9	36
In-hospital mortality *	5.2	276	4.7	74	4.4	82	6.3	120
1-year mortality (from admission) *	21.6	1,154	19.5	304	21.7	408	23.1	442
1-year mortality (from discharge) [b]	17.9	906	16.3	242	18.5	332	18.5	332
Home care (≤ days of discharge) [b,c, **]	65.7	2,965	61.7	808	64.6	1,036	70.0	1,121
Re-hospitalization (within 1 year) [b]	33.5	1,701	33.0	490	32.9	590	34.6	621

[a] COPD - Chronic obstructive pulmonary disease
[b] excludes in-hospital deaths (n=276)
[c] excludes direct transfers to nursing home at discharge (n=563)
*p<.05,
**p<.01 (for difference across 3-year study interval)

Table 2: Adjusted † Odds Ratios (95% Confidence Intervals) For In-Hospital Mortality ¶ Associated With Demographic & Health Characteristics Among Patients Admitted To Hospital For Hip Fractures In Alberta 1994/95 – 1996/97

Variable	Adjusted OR (95% CI)
Age	
<65 years (ref)	1.00
65-74	2.28 (0.99, 5.20)
75-84	4.50 (2.13, 9.51)****
85+	6.20 (2.93, 13.12)****
Sex (Male)	1.97 (1.50, 2.59)****
Length of Stay§	
Short (1-5 days)	2.87 (2.08, 3.95)****
Intermediate (6-15 days)	1.00
Long (16+ days)	1.49 (1.10, 2.02)*
Comorbid conditions	
Cerebrovascular disease/hemiplegia	2.19 (1.58, 3.04)****
Cancer	3.24 (2.06, 5.10)****
COPD	1.37 (1.01, 1.84)*
Dementia	1.42 (1.06, 1.91)*
Chronic renal disease	2.57 (1.35, 4.90)**
Congestive heart failure	4.05 (3.06, 5.37)****

† Obtained from multivariate logistic regression model, also adjusted for year and other comorbid conditions (diabetes & complications, myocardial infarction, rheumatologic disease, peptic ulcer disease, peripheral vascular disease).

¶ in-hospital deaths (276)

§ Length of in-patient stay in days was categorized to provide short, intermediate and long stay groups representing approximately 20, 60, and 20 percent of the sample, respectively.

*p<.05, **p<.01, ***p<.001, ****p≤.0001

Table 3: Adjusted † Hazards Ratios (95% Confidence Intervals) For Mortality Within 1-Year (From Discharge) ¶ Associated With Demographic & Health Characteristics Among Patients Admitted To Hospital For Hip Fractures In Alberta 1994/95 – 1996/97

Variable	Adjusted HR (95% CI)
Age	
<65 years (ref)	1.00
65-74	2.11 (1.43, 3.12)***
75-84	3.08 (2.15, 4.43)****
85+	4.52 (3.14, 6.50)****
Sex (Male)	1.51 (1.30, 1.74)****
Year	
1994-95 (ref)	1.00
1995-96	1.19 (1.01, 1.41)*
1996-97	1.15 (0.97, 1.36)
Length of Stay§	
Short (1-5 days)	1.0 (0.83, 1.21)
Intermediate (6-15 days)	1.00
Long (16+ days)	1.65 (1.41, 1.93)****
Comorbid conditions	
Cerebrovascular disease/hemiplegia	1.41 (1.18, 1.70)***
Cancer	2.81 (2.22, 3.57)****
COPD	1.60 (1.37, 1.86)****
Dementia	1.61 (1.38, 1.87)****
Chronic renal disease	1.87 (1.23, 2.85)**
Congestive heart failure	1.57 (1.33, 1.85)****
Discharge Location	
Community (ref)	1.00
Long-term care	1.65 (1.36, 2.00)****
Acute care	2.15 (1.74, 2.65)****
Rehabilitation	0.84 (0.51, 1.37)
Other	2.01 (1.22, 3.32)**
Home Care (within 90 days)	0.55 (0.48, 0.64)****

† Obtained from multivariate Cox proportional hazards regression model, also adjusted for other comorbid conditions (diabetes & complications, myocardial infarction, rheumatologic disease, peptic ulcer disease, peripheral vascular disease).

¶ 906 patients with event of interest compared with 4,170 censored subjects, excludes in-hospital deaths (276)

§ Length of in-patient stay in days was categorized to provide short, intermediate and long stay groups representing approximately 20, 60, and 20 percent of the sample, respectively.

*p<.05; **p<.01; ***p<.001; ****p≤.0001

Table 4: Adjusted † Hazards Ratios (95% Confidence Intervals) For Re-Hospitalization Within 1-Year ¶ Associated With Demographic & Health Characteristics Among Patients Admitted To Hospital For Hip Fractures In Alberta 1994/95 – 1996/97

Variable	Adjusted HR (95% CI)
Age	
< 65 years (ref)	1.00
65-74	0.95 (0.80, 1.13)
75-84	0.91 (0.77, 1.07)
85+	0.80 (0.67, 0.95)*
Length of Stay §	
Short (1-5 days)	0.86 (0.74, 0.99)*
Intermediate (6-15 days)	1.00
Long (16+ days)	1.27 (1.13, 1.42)****
Comorbid conditions	
Diabetes & complications	1.22 (1.05, 1.41)**
Cancer	1.33 (1.05, 1.68)*
Myocardial infarction	1.38 (1.18, 1.62)****
COPD	1.28 (1.14, 1.44)****
Dementia	0.84 (0.72, 0.99)*
Congestive heart failure	1.29 (1.12, 1.49)***
Discharge Location	
Community (ref)	1.00
Long-term care	0.97 (0.85, 1.10)
Acute care	1.54 (1.35, 1.75)****
Rehabilitation	1.15 (0.91, 1.47)
Other	0.96 (0.58, 1.59)
Home Care (within 90 days)	1.62 (1.44, 1.82)****

† Obtained from multivariate Cox proportional hazards regression model, also adjusted for age, sex, year and other comorbid conditions (cerebrovascular disease/hemiplegia, rheumatologic disease, peptic ulcer disease, chronic renal disease, peripheral vascular disease).

¶ 1,701 patients with event of interest compared with 3,375 censored subjects, excludes in-hospital deaths (276)

§ Length of in-patient stay in days was categorized to provide short, intermediate and long stay groups representing approximately 20, 60, and 20 percent of the sample, respectively.

*p<.05; **p<.01; ***p<.001; ****p≤.0001

Table 5: Adjusted † Hazards Ratios (95% Confidence Intervals) For Receipt Of Home Care (Within 90 Days From Discharge) ¶ Associated With Demographic & Health Characteristics Among Patients Admitted To Hospital For Hip Fractures In Alberta 1994/95 – 1996/97

Variable	Adjusted HR (95% CI)
Age	
< 65 years (ref)	1.00
65-74	1.94 (1.69, 2.23)****
75-84	2.27 (1.99, 2.59)****
85+	2.08 (1.80, 2.40)****
Sex (Male)	0.77 (0.71, 0.84)****
Year	
1994-95 (ref)	1.00
1995-96	1.10 (1.00, 1.21)*
1996-97	1.31 (1.20, 1.44)****
Length of Stay §	
Short (1-5 days)	0.67 (0.60, 0.75)****
Intermediate (6-15 days)	1.00
Long (16+ days)	1.49 (1.37, 1.63)****
Comorbid conditions	
Dementia	0.39 (0.34, 0.45)****
Rheumatologic disease	1.26 (1.05, 1.52)*
Peptic ulcer disease	1.36 (1.07, 1.72)*
Discharge Location	
Community (ref)	1.00
Long-term care	0.58 (0.53, 0.64)****
Acute care	0.71 (0.65, 0.79)****
Rehabilitation	0.58 (0.48, 0.69)****
Other	0.12 (0.06, 0.24)****

† Obtained from multivariate Cox proportional hazards regression model, also adjusted for other comorbid conditions (congestive heart failure, diabetes & complications, cerebrovascular disease/hemiplegia, cancer, myocardial infarction, chronic obstructive pulmonary disease, chronic renal disease, peripheral vascular disease).

¶ 2,835 patients with event of interest compared with 1,548 censored subjects, excludes in-hospital deaths (276) and patients transferred to nursing home at discharge (563)

*p<.05; **p<.01; ***p<.001; ****p≤.0001

Table 6: Adjusted † Regression Estimates For Length Of Hospital Stay ¶ Associated With Demographic & Health Characteristics Among Hip Fracture Patients In Alberta 1994/95 – 1996/97

Variable	Beta Estimate (standard error)
Age	
< 65 years (ref)	
65-74	1.503 (0.627)*
75-84	2.934 (0.565)****
85+	3.575 (0.595)****
Year	
1994-95 (ref)	
1995-96	-1.700 (0.436)****
1996-97	-2.013 (0.434)****
Comorbid conditions	
Cerebrovascular disease/hemiplegia	4.013 (0.595)****
Cancer	2.113 (0.940)*
Chronic renal disease	4.184 (1.464)**
Peripheral vascular disease	2.749 (0.891)**
Congestive heart failure	3.167 (0.541)****
Health Region	
Calgary (ref)	
Capital	-4.157 (0.466)****
Others	-4.817 (0.417)****

† Obtained from multivariate linear regression model, also adjusted for sex, in-hospital mortality and other comorbid conditions (diabetes & complications, myocardial infarction, chronic obstructive pulmonary disease, dementia, rheumatologic disease, peptic ulcer disease).

¶ excludes patients (n=37) with length of stay >100 days

*p<.05; **p<.01; ***p<.001; ****p≤.0001

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FIGURES 1 - 13

Figure 1: Rate (Per 1,000 Residents) Of Hospitalizations Due To Hip Fractures By Sex And Age Group, Alberta 1994/95 – 1996/97

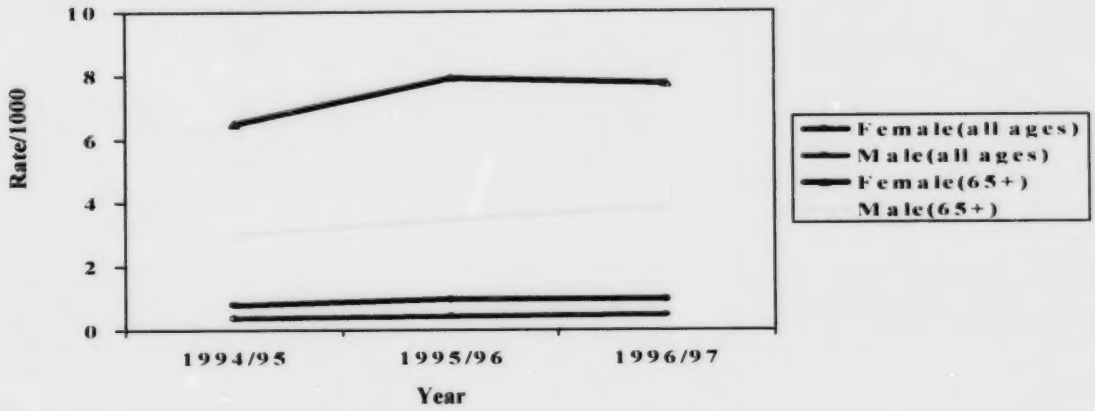


Figure 2: Age-Specific Rate (Per 1000 Residents) Of Hospitalizations Due To Hip Fractures, Alberta 1994/95-1996/7

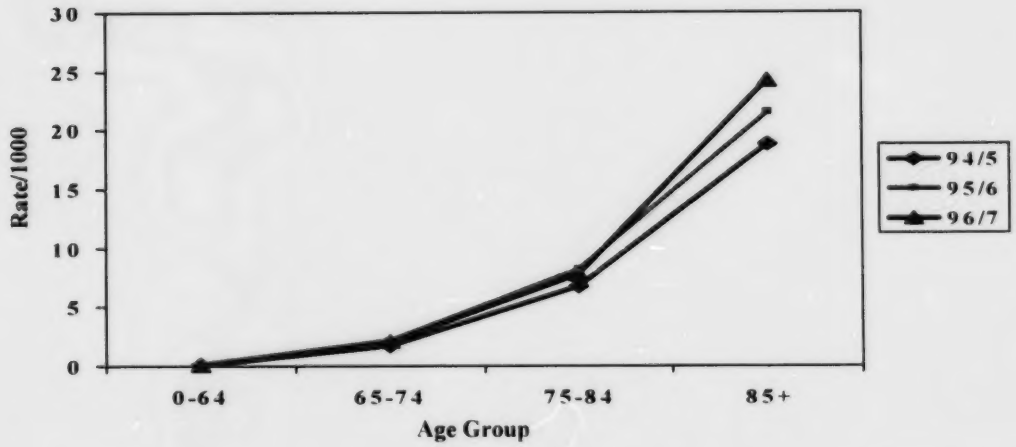


Figure 3: Age-Specific Rate (Per 1,000 Residents) Of Hospitalizations Due To Hip Fractures - Females, Alberta 1994/95 – 1996/97

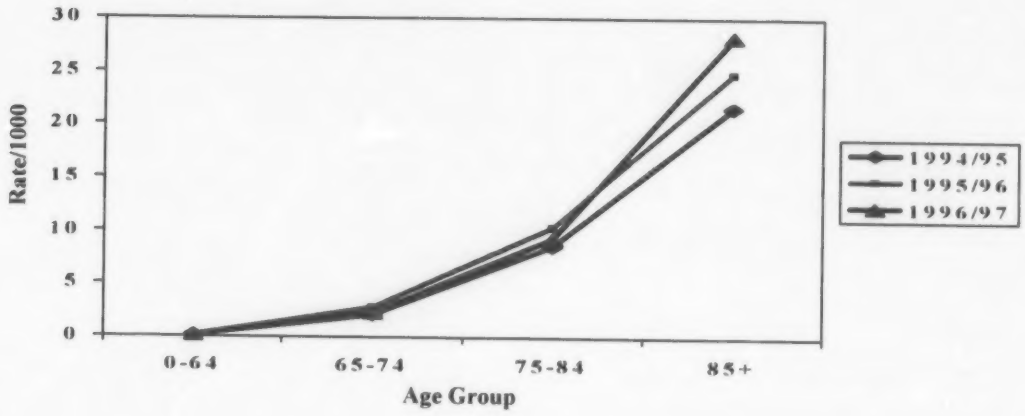


Figure 4: Age-Specific Rate (Per 1,000 Residents) Of Hospitalizations Due To Hip Fractures - Males, Alberta 1994/95 – 1996/97

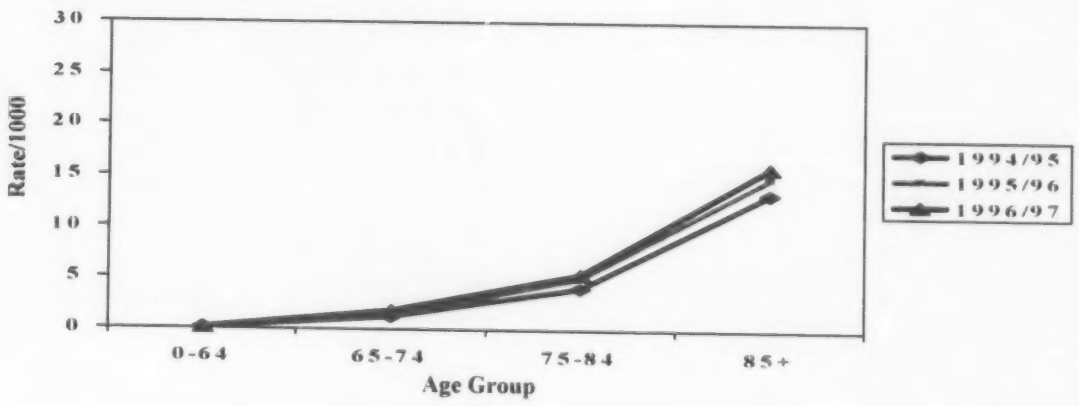


Figure 5a: Number Of Hospitalizations Due To Hip Fractures - Females 94/95 - 96/97

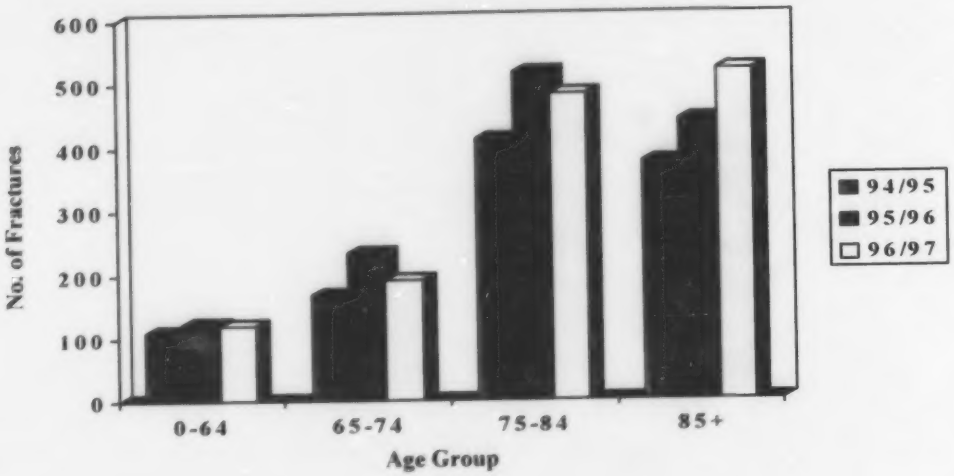


Figure 5b: Number Of Hospitalizations Due To Hip Fractures - Males 94/95 - 96/97

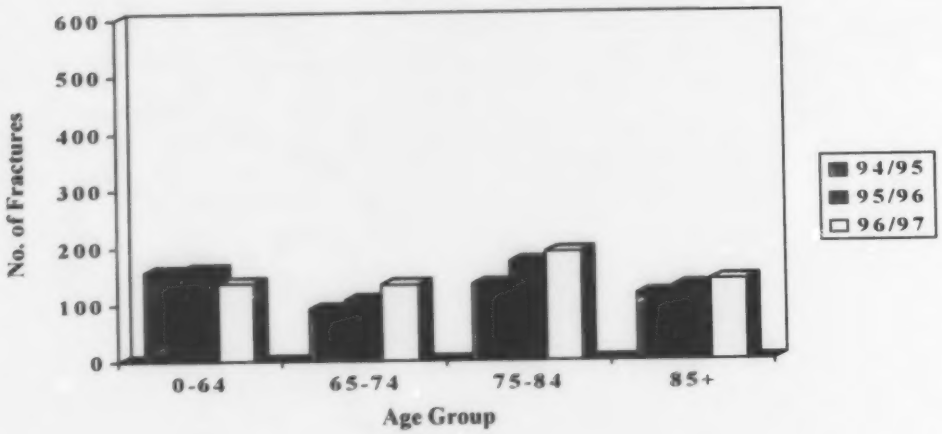


Figure 6: Distribution Of Hip Fracture Hospitalizations (All Ages) By Season & Year, Alberta 1994/95 – 1996/97

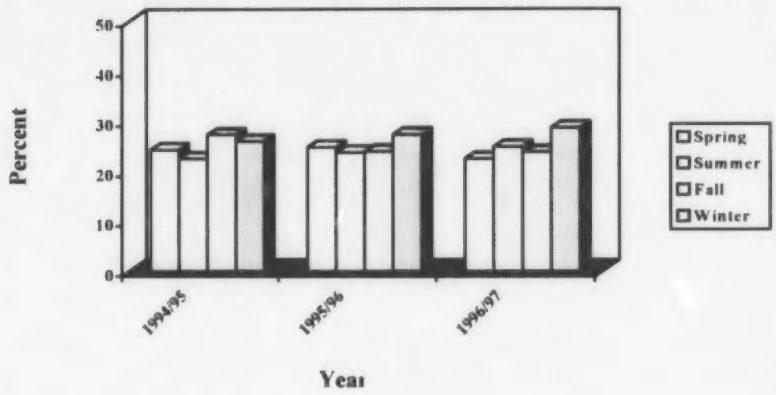


Figure 7a: Distribution Of Hip Fracture Hospitalizations (All Ages) By Season & Year – Males, Alberta 1994/95-1996/97

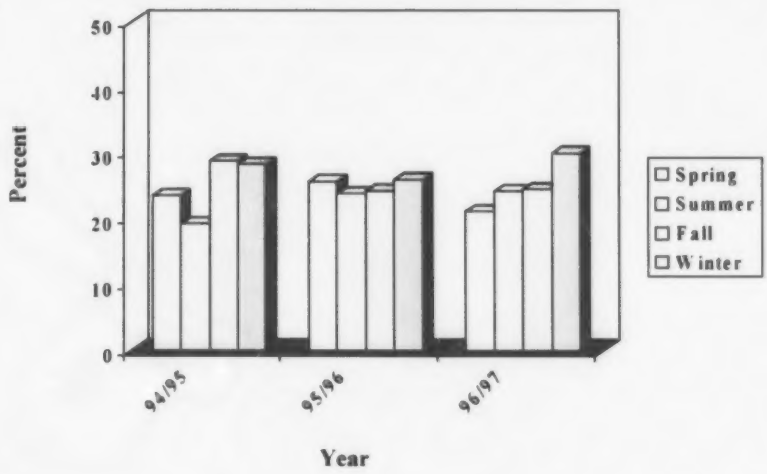


Figure 7b: Distribution Of Hip Fracture Hospitalizations (All Ages) By Season & Year – Females, Alberta 1994/95-1996/97

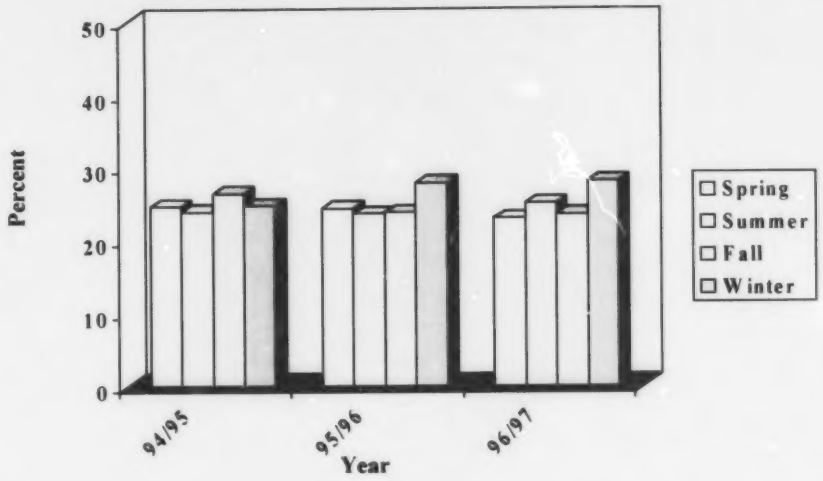


Figure 8: Distribution Of Hip Fracture Hospitalizations (65+) By Season & Year, Alberta 1994/95 – 1996/97

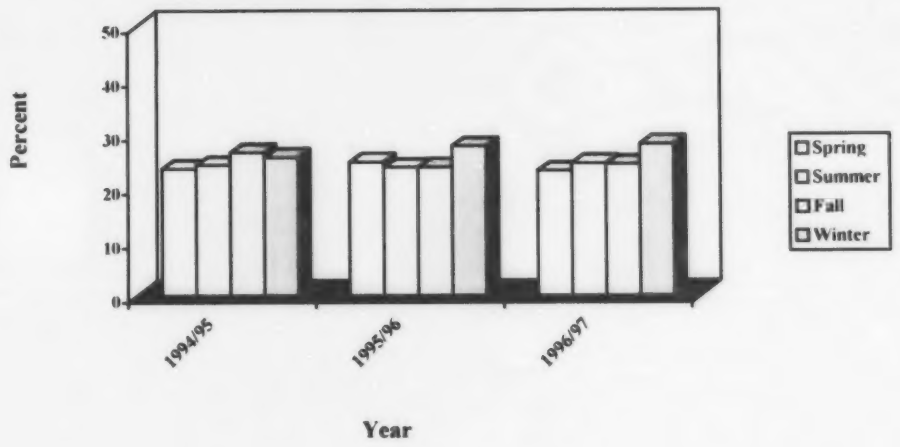


Figure 9a: Distribution Of Hip Fracture Hospitalizations (65+) By Season & Year – Males, Alberta 1994/95-1996/97

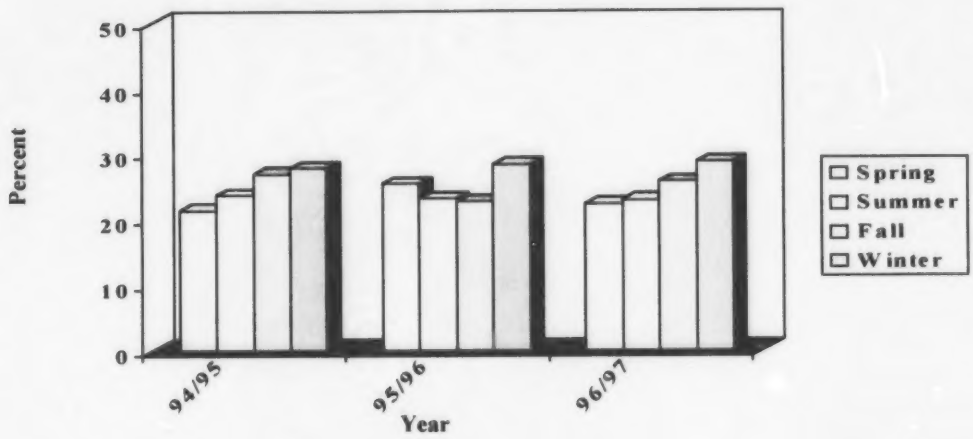


Figure 9b: Distribution Of Hip Fracture Hospitalizations (65+) By Season & Year – Females, Alberta 1994/95-1996/97

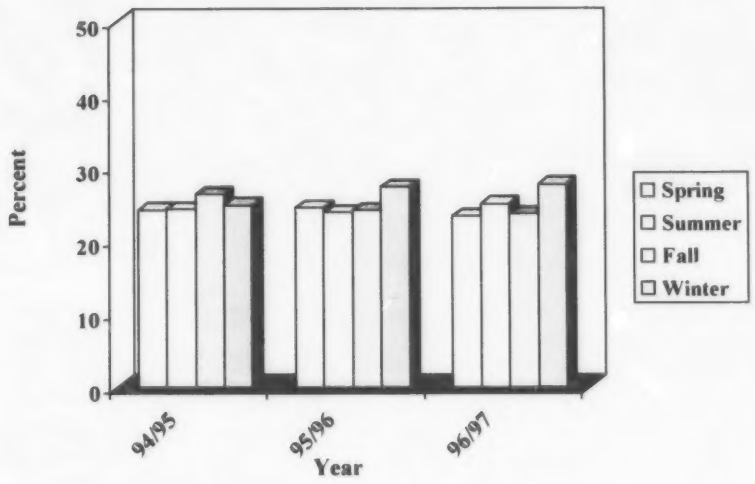
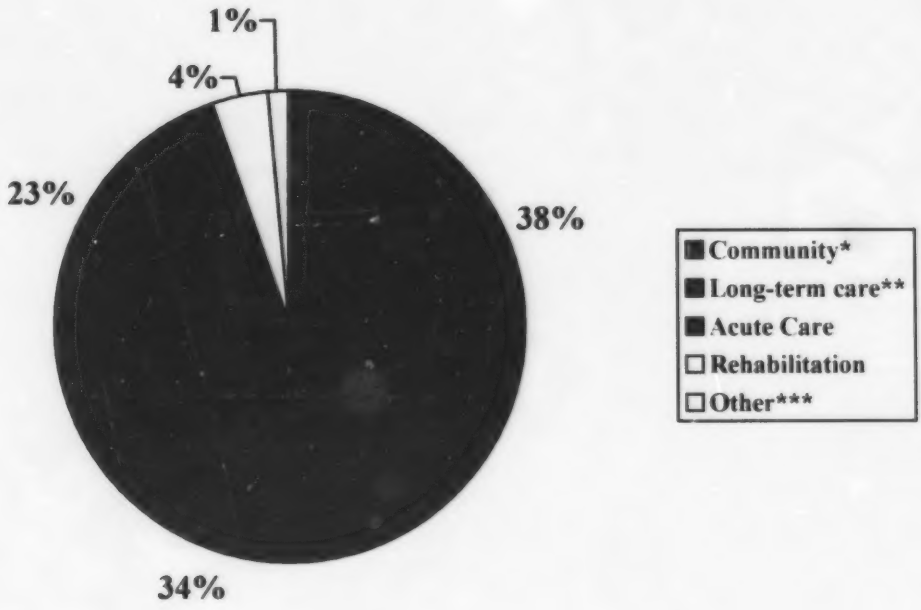


Figure 10: Discharge Location For Patients Hospitalized Due To Hip Fractures, Alberta 1994/95 - 1996/97 (n=5,076)†



† excludes in-hospital deaths (n=276)

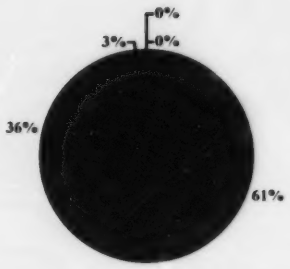
* community (n=1,902): includes private dwelling (1,626), private dwelling with home care (191), senior lodge (85)

** long-term care (n=1,727) includes: nursing home (563), auxiliary hospital (938), sub-acute beds in long-term care (226)

*** other (n=72) includes: same day surgery (1), emergency department (1), psychiatric facilities (40), unclassified health institutions (30)

Figure 11: Discharge Location For Patients Hospitalized Due To Hip Fractures By Major Health Region, Alberta 1994/95 - 1996/97

Calgary Region (n=1,480).



Capital Region (n=1,346).

Other Regions (n=2,250).

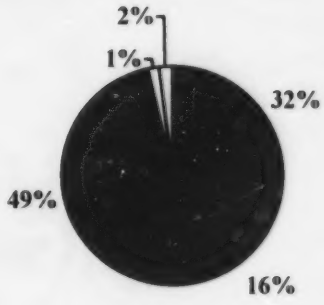


Figure 12: Mortality Outcomes For Patients Hospitalized Due To Hip Fractures, Alberta 1994/95 – 1996/97

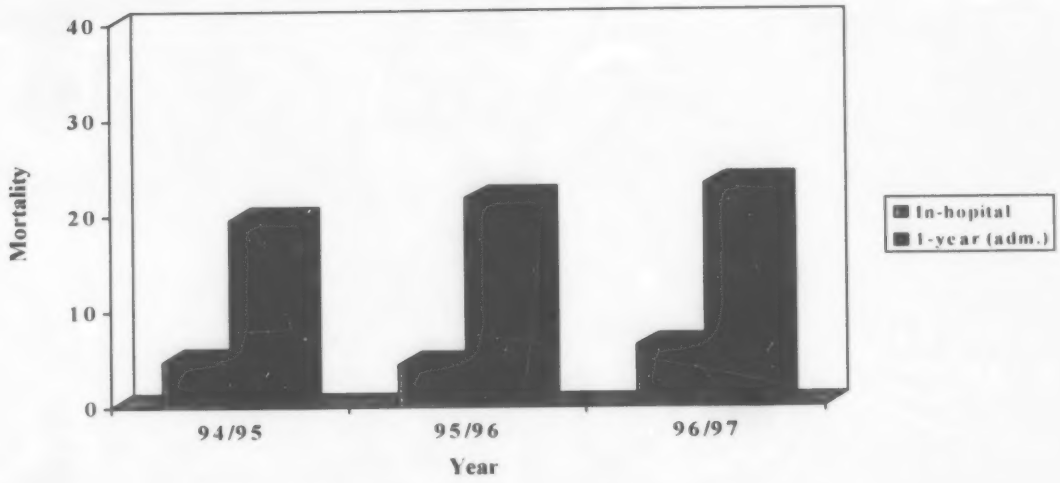
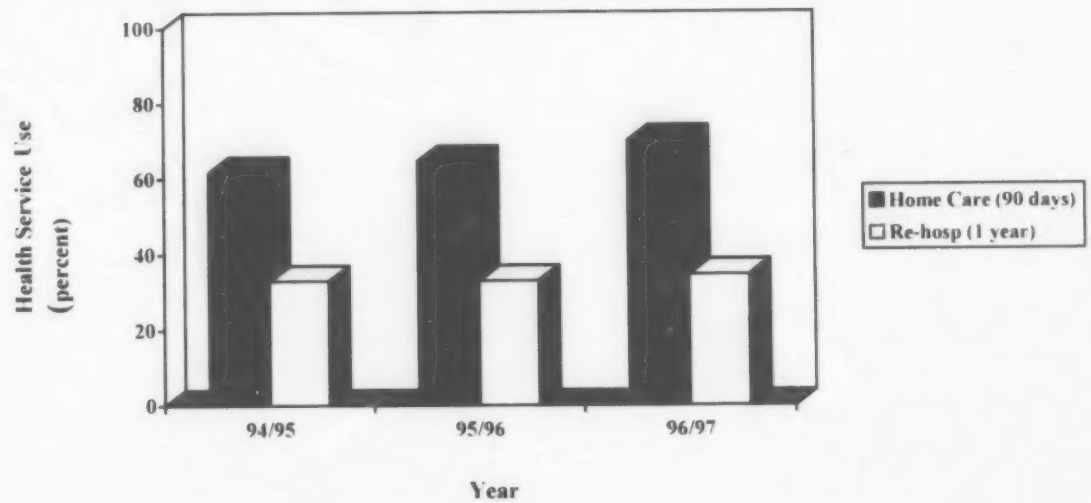


Figure 13: Health Service Outcomes (Post-Discharge) Among Patients Hospitalized Due To Hip Fractures, Alberta 1994/95 – 1996/97



APPENDIX A: ADDITIONAL TABLES FOR FIGURES 1-13

Table A1: Number And Rate (Per 1,000 Residents) Of Hospitalizations Due To Hip Fractures By Sex And Age Group, Alberta 1994/95 – 1996/97

* See Figure 1

	1994/95		1995/96		1996/97	
	No. of fractures	Rate	No. of fractures	Rate	No. of fractures	Rate
Female (all ages)	1,063	0.78	1,310	0.96	1,311	0.95
Male (all ages)	497	0.37	568	0.42	603	0.44
Female (65+)	955	6.47	1,188	7.89	1,192	7.72
Male (65+)	341	2.99	408	3.48	465	3.86

Table A2: Number And Age-Specific Rate (Per 1,000 Residents) Of Hospitalizations Due To Hip Fractures, Alberta 1994/95-1996/7

* See Figure

	0-64		65-74		75-84		85+	
	No. of fractures	Rate	No. of fractures	Rate	No. of fractures	Rate	No. of fractures	Rate
1994/95	264	0.11	259	1.68	546	6.70	491	18.78
1995/96	282	0.11	340	2.17	688	8.18	568	21.50
1996/97	257	0.10	617	2.03	674	7.68	659	24.19

Table A3: Number And Age-Specific Rate (Per 1000 Residents) Of Hospitalizations Due To Hip Fractures - Females, Alberta 1994/95 – 1996/97

* See Figure 3, Figure 5a

	0-64		65-74		75-84		85+	
	No. of fractures	Rate	No. of fractures	Rate	No. of fractures	Rate	No. of fractures	Rate
1994/95	108	0.09	168	2.05	412	8.53	375	21.56
1995/96	122	0.10	233	2.81	516	10.34	439	24.75
1996/97	119	0.10	190	2.26	483	9.27	519	28.23

Table A4: Number And Age-Specific Rate (Per 1000 Residents) Of Hospitalizations Due To Hip Fractures - Males, Alberta 1994/95 – 1996/97

* See Figure 4, Figure 5b

	0-64		65-74		75-84		85+	
	No. of fractures	Rate	No. of fractures	Rate	No. of fractures	Rate	No. of fractures	Rate
1994/95	156	0.13	91	1.26	134	4.04	116	13.26
1995/96	160	0.13	107	1.44	172	5.03	129	14.85
1996/97	138	0.11	134	1.76	191	5.35	140	15.81

Table A5: Distribution Of Hip Fracture Hospitalizations (All Ages) By Season & Year, Alberta 1994/95 - 1996/97

* See Figure 6

	1994/95		1995/96		1996/97	
Month	No. of fractures	Percent	No. of fractures	Percent	No. of fractures	Percent
Spring	379	24.3	466	24.8	430	22.5
Summer	351	22.5	447	23.8	476	24.9
Fall	425	27.3	451	24.0	458	23.9
Winter	405	26.0	514	27.4	550	28.7
Total	1,560	100	1,878	100	1,914	100

Table A6: Distribution Of Hip Fracture Hospitalizations (All Ages) By Season & Year - Males, Alberta 1994/95 - 1996/97

* See Figure 7a

	1994/95		1995/96		1996/97	
Month	No. of fractures	Percent	No. of fractures	Percent	No. of fractures	Percent
Spring	117	23.5	146	25.7	128	21.2
Summer	96	19.3	136	23.9	146	24.2
Fall	143	28.8	138	24.3	148	24.5
Winter	141	28.4	148	26.1	181	30.0
Total	497	100	568	100	603	100

Table A7: Distribution Of Hip Fracture Hospitalizations (All Ages) By Season & Year - Females, Alberta 1994/95 - 1996/97

* See Figure 7b

	1994/95		1995/96		1996/97	
Month	No. of fractures	Percent	No. of fractures	Percent	No. of fractures	Percent
Spring	262	24.7	320	24.4	302	23.0
Summer	255	24.0	311	23.7	330	25.2
Fall	282	26.5	313	23.9	310	23.7
Winter	264	24.8	366	27.9	369	28.2
Total	1,063	100	1,310	100	1,311	100

Table A8: Distribution Of Hip Fracture Hospitalizations (65+) By Season & Year, Alberta 1994/95 - 1996/97

* See Figure 8

	1994/95		1995/96		1996/97	
Month	No. of fractures	Percent	No. of fractures	Percent	No. of fractures	Percent
Spring	305	23.5	395	24.8	383	23.1
Summer	314	24.2	379	23.8	406	24.5
Fall	344	26.5	380	23.8	403	24.3
Winter	333	25.7	442	27.7	465	28.1
Total	1,296	100	1,596	100	1,657	100

Table A9: Distribution of Hip Fracture Hospitalizations (65+) by Season & Year - Males, Alberta 1994/95 - 1996/97

* See Figure 9a

	1994/95		1995/96		1996/97	
Month	No. of fractures	Percent	No. of fractures	Percent	No. of fractures	Percent
Spring	73	21.4	104	25.5	104	22.4
Summer	81	23.8	95	23.3	107	23.0
Fall	92	27.0	93	22.8	120	25.8
Winter	95	27.9	116	28.4	134	28.8
Total	341	100	408	100	465	100

Table A10: Distribution Of Hip Fracture Hospitalizations (65+) By Season & Year - Females, Alberta 1994/95 - 1996/97

* See Figure 9b

	1994/95		1995/96		1996/97	
Month	No. of fractures	Percent	No. of fractures	Percent	No. of fractures	Percent
Spring	232	24.3	291	24.5	279	23.4
Summer	233	24.4	284	23.9	299	25.1
Fall	252	26.4	287	24.2	283	23.7
Winter	238	24.9	326	27.4	331	27.8
Total	955	100	1,188	100	1,192	100

Table A11: Mortality Outcomes For Patients Hospitalized Due To Hip Fractures, Alberta 1994/95 – 1996/97

*See Figure 12

	94/95		95/96		96/97	
	Number	%	Number	%	Number	%
In-hospital Mortality	74	4.7	82	4.4	120	6.3
1-year Mortality (from adm.)	304	19.5	408	21.7	442	23.1

Table A12: Health Service Outcomes (Post-Discharge) Among Patients Hospitalized Due To Hip Fractures, Alberta 1994/95 – 1996/97

*See Figure 13

	94/95		95/96		96/97	
	Number	%	Number	%	Number	%
Home Care (90 days)	808	61.7	1,036	64.6	1,121	70.0
Re-hospitalization (1 year)	490	33.0	590	32.9	621	34.6

Table A13: Discharge Location & Health Care Characteristics Of Patients Hospitalized Due To Hip Fractures By Regional Health Authority, Alberta 1994/95–1996/97

RHA (total # cases)	#Cases Discharge Alive †	Discharge Location † Community*	LTC**	Acute Care	Rehab.	Other***	Home Care (≤90 days of discharge)‡
		Percent (number)					
1 Chinook (366)	341	40.8 (139)	28.2 (96)	30.8 (105)	0.0 (0)	0.3 (1)	74.8 (241)
2 Palliser (223)	214	50.5 (108)	24.3 (52)	24.8 (53)	0.0 (0)	0.5 (1)	59.0 (105)
3 Headwaters (148)	145	38.6 (56)	6.2 (9)	55.2 (80)	0.0 (0)	0.0 (0)	60.1 (86)
4 Calgary (1,576)	1,480	60.5 (896)	36.4 (539)	3.0 (45)	0.0 (0)	0.0 (0)	67.5 (797)
5 Health Region #5 (120)	115	27.8 (32)	10.4 (12)	61.7 (71)	0.0 (0)	0.0 (0)	55.0 (61)
6 David Thompson (400)	384	39.1 (150)	13.8 (53)	43.0 (165)	0.8 (3)	3.4 (13)	68.5 (244)
7 East Central (299)	286	18.9 (54)	16.1 (46)	53.2 (152)	3.5 (10)	8.4 (24)	58.7 (165)
8 Westview (93)	90	20.0 (18)	17.8 (16)	55.6 (50)	6.7 (6)	0.0 (0)	63.9 (53)
9 Crossroads (137)	131	15.3 (20)	7.6 (10)	73.3 (96)	1.5 (2)	2.3 (3)	60.0 (78)
10 Capital (1,426)	1,346	21.8 (293)	61.7 (831)	2.1 (28)	12.5 (168)	1.9 (26)	70.1 (848)
11 Aspen (158)	155	20.0 (31)	13.6 (21)	63.9 (99)	2.6 (4)	0.0 (0)	60.0 (87)
12 Lakeland (206)	197	15.2 (30)	12.2 (24)	68.0 (134)	3.1 (6)	1.5 (3)	52.7 (99)
13 Mistahia (106)	102	56.9 (58)	15.7 (16)	27.5 (28)	0.0 (0)	0.0 (0)	60.8 (59)
14 Peace (34)	32	12.5 (4)	6.3 (2)	75.0 (24)	6.3 (2)	0.0 (0)	54.8 (17)
15 Keeweetinok (31)	30	26.7 (8)	0.0 (0)	73.3 (22)	0.0 (0)	0.0 (0)	43.3 (13)
16 Northern Lights (16)	15	13.3 (2)	0.0 (0)	80.0 (12)	0.0 (0)	6.7 (1)	46.7 (7)
17 Northwestern (13)	13	23.1 (3)	0.0 (0)	76.9 (10)	0.0 (0)	0.0 (0)	38.5 (5)
Total (5,352)	5,076	1,902	1,727	1,174	201	72	2,965

† excludes in-hospital deaths (n=276)
‡ excludes in-hospital deaths (n=276) and direct transfers to nursing home at discharge (n=563)
* community includes: private dwelling, private dwelling with home care, senior citizens lodge
** long-term care includes: nursing home, auxiliary hospital, sub-acute beds in long-term care
*** other includes: same day surgery, emergency department, psychiatric facilities, unclassified health institutions

BIOGRAPHIES

Colleen J. Maxwell, PhD.

Dr. Colleen Maxwell is an Assistant Professor in the Departments of Community Health Sciences and Medicine (Division of Geriatric Medicine), University of Calgary. She received her Masters in Gerontology and PhD in Health Studies from the Faculty of Applied Health Sciences, University of Waterloo. Her primary research interests are in the areas of Aging and Health, Pharmacoepidemiology, Alzheimer's disease and related disorders, Older Women's Health and Health Services and Outcomes Research. Dr. Maxwell's work is funded by a Population Health Investigator Award from the Alberta Heritage Foundation for Medical Research and she is a Fellow with the Institute of Health Economics in Edmonton, Alberta.

Hude Quan, M.D., PhD.

PhD of Epidemiology (University of Calgary, Alberta)

Diploma of Maternal and Child Health (University of London, UK)

Population and Economic Training Program (Asia and Pacific Development Centre of the United Nations, Malaysia)

Master of Public Health (Harbin Medical University, China)

M.D. (Harbin Medical University, China)

Consultant for the Alberta Centre for Health Services Utilization Research and the Department of Community Health Sciences of the University of Calgary

Dr. Hude Quan served as Deputy Director of the teaching and research committee, The Dept. of Social Medicine, Harbin Medical University, China, and as Epidemiologist of the National Prevention of Rickets Co-operative, Research Program of China. He was also a lecturer in Public Health (undergraduate and graduate courses) at Harbin Medical University, China. Since 1994, he as worked on research at the Department of Community Health Sciences, University of Calgary. Dr. Quan has published numerous reports and abstracts. His interests are evaluation of health service outcome and alternative medicine, and psychiatric epidemiology.

David B. Hogan

M.D. (Dalhousie University)

F.A.C.P. (Internal Medicine)

F.R.C.P. (Internal Medicine/Geriatric Medicine)

Professor and Brenda Strafford Chair in Geriatric Medicine, University of Calgary.

Currently involved in research on cognitive impairment/dementia, population therapeutics, clinical geriatrics, and health services for seniors.

Contact Information:

Health Sciences Centre
3330 Hospital Dr. NW
Calgary, Alberta T2N 4N1
E-mail: dhogan@ucalgary.ca
Phone: 403-220-8474
Fax: 403-283-1089

Jenny X. Zhang, M.P.A., M.E.C

Master of Public Administration (University of Victoria)

Master of Economics (Northern JiaoTong University)

Research Assistant, Institute of Health Economics. She is currently conducting literature reviews and analytical supports in two research areas: health utilization in elderly people and "gaming" behaviors in physicians.

Contact Information:

Heritage Medical Research Building
3330 Hospital Drive NW
Calgary, AB, Canada T2N 4N1